THE EFFECT OF CERVICAL MUSCLES CORDINATION RETRAINING EXERCISES ON PAIN REDUCTION AND POSTURAL CORRECTION IN PATIENTS WITH CERVICOGENIC HEADACHE.
- A QUASI EXPERIMENTAL STUDY

Dissertation submitted to The Tamil Nadu Dr. M.G.R. Medical University towards partial fulfillment of the requirements of **Master of Physiotherapy [Advanced PT in Orthopaedics] Degree Programme.**

KMCH COLLEGE OF PHYSIOTHERAPY

(A unit of Kovai Medical Center Research & Educational Trust)

Post Box No. 3209, Avinashi Road,

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2014 - 2016

Certificate

CERTIFICATE

This is to certify that research work entitled **"THE EFFECT OF CERVICAL MUSCLES CORDINATION RETRAINING EXERCISES ON PAIN REDUCTION AND POSTURAL CORRECTION IN PATIENTS WITH CERVICOGENIC HEADACHE"** was carried out by the candidate bearing the **Register No: 271410084,** KMCH College Of Physiotherapy towards partial fulfillment of the requirements of the **Master of physiotherapy** (Advanced PT in orthopaedics) of the Tamil Nadu Dr. M.G.R Medical University, Chennai-32.

PROJECT GUIDE

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INTERNAL EXAMINER

EXTERNAL EXAMINER

Project Evaluated on:

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ABSTRACT

OBJECTIVE

To compare the effect of cervical muscles coordination retraining exercises along with medication and medication alone on pain reduction, improving the cervical muscle strength and postural correction in patients with cervicogenic headache.

STUDY DESIGN

Quasi experimental study design.

METHOD

30 subjects with cervicogenic headache were included in the study with 15 in each group. Subjects were from 20 – 45 years. One group received cervical muscle coordination retraining exercises along with medication and the other group received only medication.

OUTCOME MEASURES

The pretest and posttest values were taken for verbally administered numeric rating scale, frequency of headache, craniovertebral angle and craniocervical flexion test.

RESULTS

Statistical analysis were done using paired 't' test for comparing within the group and independent 't' test for comparing between the groups. Both groups show significant differences before and after the treatment. This was done to find out the effect of exercises on cervicogenic headache.

CONCLUSION

It was concluded that, the exercises with medication group was more effective than the medication group for patients with cervicogenic headache in reducing intensity and frequency of pain, improving craniovertebral angle and craniocervical flexion test. Henceforth these exercises can be used along with the medication as effective intervention.

KEY WORDS

Craniovertebral angle, craniocervical flexion test, cervicogenic headache.

1. INTRODUCTION

Headaches are a common disorder and often incapacitating condition. In the general population, at least 90% of individuals experience headache at some stages of their life. The headache classification committee of the international headache society has classified headache into primary and secondary types. Cervicogenic headaches been classified as secondary headache and defined as "headache caused by a disorder of cervical spine and its component body, disc and/or soft tissue elements, usually but not invariably accompanied by neck pain." Recent population based studies found the incidence of cervicogenic headache has been estimated to be 14 to 18 % from all chronic headache. And also it is more prevalent in women. However 70% of persons who are having cervicogenic headache have neck symptoms associated with their headache.

In 1983, Sjaastad and colleagues first characterized the features of headache type that they felt was very likely to originate in cervical spine and applied the term cervicogenic headache. He documented a diagnostic criterion for cervicogenic headache in 1990 and revised it in 1998.

The features of cervicogenic headache include precipitation of head pain by neck movement and/or sustained awkward head position and/or by external pressure over the upper cervical or occipital region on the symptomatic side; ipsilateral neck, shoulder or arm pain of a rather vague nonradicular nature or occasionally arm pain of a radicular nature; unilaterality of the head pain without side shift. The head pain in cervicogenic headache is characterized by moderate-severe, nonthrobbing and nonlancinating pain usually starting in the neck with duration from few hours to few days or a couple of weeks of fluctuating or in a continuous pattern.

Some of the studies documented the disturbance in the neck flexor synergy in patients with cervicogenic headache. The cervical neuromuscular control is provided by the combined activity of deep and superficial muscles of cervical spine. The altered strategies of this neuromuscular control in the cervical region is mainly occur due to pain, pathology and abnormal posture and it may compromise the active support of cervical spine segments. The uncoordinated patterns of muscles activity and

neuromuscular control thus reduce the stability of cervical segments and the functional movements.

The deep neck flexor muscles have a vital role in supporting the cervical segments and cervical curve. The weakness of this muscle contributes the increased cervical lordosis. And this sustained posture expected as an aggravating factor when a headache is arising from the neck.

The conservative treatment of Cervicogenic headache includes pharmaceutical agents (simple analgesics and NSAIDS) and a variety of physical therapies. Physical therapy include manipulative therapy, traction, trigger point therapy, muscle stretching, cold packs, hot packs and TENS. Cognitive behavioral programs have also been tested. In addition to that, various medical and surgical procedures have been used. The efficacy of physical therapy management is being evaluated within the framework of evidence based healthcare. But for a successful outcome, the first criterion is to treat the patient for whom the intervention is appropriate.

1.1 NEED FOR THE STUDY

Patients who seek medical care for their headache are being treated by prescribing analgesics and anti-inflammatory drugs. It's been stated by consultants that the effect of medications are temporary and the patient can have the episode of headache later in his lifetime. This is because the root cause of the disease has not been treated or removed by medications provided to the patient.

Cervicogenic headaches caused as a result of imbalance between bony and muscular structures can be effectively controlled if this imbalance is neutralized. The postural correction and muscular coordination training can be beneficial for the patient for a long lasting relief which has not been studied extensively. This study is intended to find out the effectiveness of physical therapy intervention for retraining coordination of cervical muscles in patients with cervicogenic headache for pain relief and postural correction.

1.2 AIM AND OBJECTIVES

1.2.1 AIM

- To find out the effectiveness of retraining the coordination of cervical muscles in patients with cervicogenic headache for pain relief and postural correction.

1.2.2 OBJECTIVES

- To find out whether retraining coordination of cervical muscles have an effect on reducing the intensity of cervicogenic headache in verbally administered numeric rating scale.
- To find out whether retraining coordination of cervical muscles have an effect on reducing the frequency of cervicogenic headache episodes.
- To find out whether retraining coordination of cervical muscles have an effect on craniovertebral angle.
- To find out whether retraining coordination of cervical muscles have an effect on improving craniocervical flexion test.

2. REVIEW OF LITERATURE

2.1 CERVICOGENIC HEADACHE AND ITS DIAGNOSTIC CRITERIA.

David .M et al [2005][4]

This article reviews the clinical presentation of cervicogenic headache, proposed criteria, pathophysiological mechanism and methods of diagnostic evaluation. They provide guidelines for developing a successful multidisciplinary pain management program using medication, physical treatment, osteopathic manipulative treatment and the other non-pharmacological modes of treatment.

International Classification of Headache Disorders, 2013[3]

The headache classification committee of international headache society in its third edition [beta version] has classified headache into primary and secondary types. It has considered cervicogenic headache as a secondary headache and has defined it and also given the diagnostic criteria to diagnose it.

Sjaasted T.A et al [1998][8]

The international cervicogenic headache study group has given the major and minor diagnostic criteria to diagnose cervicogenic headache.

Fabio Antonacia et al [2001][5]

Cervicogenic headache has been defined as being mainly a unilateral headache without side shift; pain streaming from the neck usually spreads to the occulofrontotemporal area. The essential features of cervicogenic headache are a combination of unilateral pain, ipsilateral diffuse shoulder and arm pain, reduced range of motion in neck, presence of mechanical precipitation mechanisms and discontinuation of the pain on anesthetic blockades in the typical case.

The differential diagnosis should be done versus migraine, hemicranias continua, spondylosis of cervical spine and tension type headache as regards to the bilateral variant of cervicogenic headache.

Giorgio Bono et al [2006][7]

Cervicogenic headache was typically a unilateral headache that can be provoked by neck movement, awkward head position/ pressures on tender points in the neck. The headache can last hours/days and the pain was usually described as either dull or piercing. Convergence of the upper cervical roots on the nucleus caudalis of the trigeminal tract was the most commonly accepted neurophysiological explanation for cervicogenic headache. In most cases, cervicogenic headache was caused by pathology in the upper aspect of the cervical spine, but the type and exact location of the pathology varies among individual case.

2.2 IMPAIRMENTS IN CERVICOGENIC HEADACHE.

Watson D.H et al [1993][9]

Their result confirms the clinical observation that, cervical headache suffer;

1) Exhibit forward head posture,

2) Demonstrate weakness of the upper cervical flexor muscles,

3) Lack of endurance of upper cervical flexor musculatures,

4) Lack of isometric endurance of upper cervical flexor musculature.

The direct relationship of endurance and forward head posture also confirm the need for specialty in terms of rehabilitation exercises. Thus should be endurance based. Because endurance training improves the efficiency of type 1 fibers and convert type 2 b fibers into type 3a fibers.

Grieve's modern manual therapy, 2nd edition:[1]

Physical dysfunction include: articular dysfunction [joints of upper cervical complrx], muscle dysfunction [muscle as a source of referred and local pain, functional aspects of muscle and movement dysfunction.]

Vernum H et al [1992][10]

They investigated cervical spine of patients who had been diagnosed as suffering from either migraine without aura/tension type headache and found that both groups have:

1) Occipital and neck pain during headaches,

2) Tender points in the upper cervical region,

3) Greatly reduced /absent cervical curve,

4) Radiological evident of joint dysfunction in upper and lower cervical spine.

Therefore they states that: these findings support the premise that the neck plays an important role in the manifestation of headache.

Inae Caroline Gadotti et al [2008][11]

In this meta-analysis study, they analyses the result of various cervicogenic headache studies. They compared the impairments in cervicogenic headache like head posture, cervical range of motion, strength and endurance of upper neck flexors, cervical extensors, flexion rotation test with the control group. And they prove that there is an association between cervicogenic headache and musculoskeletal impairments in the cervical region in a systemic and objective manner.

2.3 DIFFERENT TREATMENT STRATEGIES IN CERVICOGENIC HEADACHE.

Gwendolen Jull et al [2002][12]

This study showed that the conservative treatment of manipulative therapy and a specific exercise program are effective for the manageme nt of cervicogenic headache.

Deborah Fallah et al [2007][13]

They recommended that the postural re-education can be practice for the management of patients with cervical spine dysfunction. The results of this study demonstrate that

re-education of sitting posture to an upright neutral spinal position promotes activation of deep cervical flexor muscles.

Phil Page et al [2011][14]

They concluded that physical therapy intervention was recommended for the musculoskeletal impairments.

Paulo Martelletti et al [2004]: [15]

This review evaluate the use of drug therapy with paracetamol and NSAIDs; infliximab and botulinum toxins type A; local injection of anesthetic or corticosteroids and invasive surgical therapies for the treatment of cervicogenic headache.

Jari Y Linen et al [2010][16]

They compare the efficacy of three 12 – month training programs on headache and upper extremity pain in patients with chronic neck pain. A total of 180 patients were randomly assigned to 3 groups. The strength group performed isometric, dynamic and stretching exercises. The endurance group performed dynamic and stretching exercises. The control group performed stretching exercises. At the 12 months follow up headache had decreased by 69% in the strength group, 58% in endurance group and 37% in control group when compared with baseline. In conclusion, strength and endurance exercises, when accompanied by stretching exercises, were shown to be an effective treatment for headache and arm pain associated with neck pain.

2.4 VERBALLY ADMINISTERED NUMERICAL RATING SCALE

Bijur et al [2003][30]

Verbally administered numerical rating scales from 0 to 10 are often used to measure pain, but they have not been validated. Of 108 patients entered, 103 provided data at 30 minutes and 86 at 60 minutes. Verbally administered numerical rating scales scores were strongly correlated to visual analog scale scores at all time periods (r = 0.94, 95% Confidence interval =0.93 to 0.95). The slope of the regression line was 1.01 (95% confidence interval=0.97 to 1.06) and the y-intercept was 0.34 (95% confidence interval=0.67 to 0.01). The minimum clinically significant difference in

pain was 1.3(95% confidence interval 1.0 to 1.5) on the verbally administered numerical rating scales and 1.4 (95% confidence interval = 1.1 to 1.7) on the visual analog scale. Conclusions: The findings suggest that the verbally administered numerical rating scale can be substituted for the visual analog scale in acute pain measurement.

Keela A. Herr et al [2004][31]

Objectives of this study are to determine the psychometric properties and utility of 5 types of commonly used pain rating scales where used with younger and older adults. A total of 175 subjects. Responses of subjects to experimentally induced thermal stimuli were measured with the following pain intensity rating scales: VAS, verbal numeric rating scale, faces pain scale, verbal descriptor scale, numeric rating scale – 21 points. The verbal numerical rating scale, with which subjects were asked to verbally rate pain intensity from 0 – 10 with zero representing "no pain" and ten representing "the most intense pain imaginable", was included because of its ease in use by those with psychomotor or visual impairment and is the only measurement option that requires a verbal response.

This verbal option has demonstrated comparability to the written numeric format and was included because of its common use in clinical practice.

2.5 FREQUENCY OF HEADACHE.

Cesar Fernandez-de-las-penas et al [2006][23]

In this study, they take the subject who having headache at least 15 days per month. And a headache diary was kept for 4 weeks in order to assess the headache intensity, frequency and duration.

Diego Bettucci et al [2006][24]

They used a standard headache diary for 4 weeks and were collected the number of headache days per month and duration of headache in hours. Totally study has 2 groups. For each group they assessed these outcome measure by pre-treatment period and two treatment periods [1-2 weeks and 9-12 weeks].

Joel R. Saper et al [1994][25]

In this study all subjects kept a daily headache diary. The headache diary was used to calculate a headache index, days per week with severe headache and number of headache free day per week.

Maria Luz Cuadrado et al [2007][26]

In this study, assessor gave a headache diary to register the daily headache duration and intensity.

2.6 CRANIOVERTEBRAL ANGLE MEASUREMENT.

G. Zito et al [2006][20]

In this study, the researcher asses the postural measurement for forward head posture by using craniovertebral angle and eye-trangion angle.The craniovertebral angle reflecting the forward head posture position was the acute angle created between the horizontal plane and the line from the tip of the C_7 process to the tragion.The ear-tragion angle reflecting the head posture was measured as acute the angle between the horizontal plane and the line from the corner of the eye to the tragion.

Wunpen Chansirinukur et al [2001][21]

In this study the author has measured craniovertabral angle at the intersection of a horizontal line through the spinous process of C_7 and a line to the tragus of the ear.

Watson D.H et al [1993][9]

In this study the craniovertabral angle was measured between the C_7 process and the tragus of the ear.

Maureen P. McEvoy et al [2005][22]

In this study they used craniovertebral angle, head posture angle and lower limb angle to measure upright postures.

2.7 CRANIOCERVICAL FLEXION TEST.

De Borah Falla et al [2003][17]

This EMG study investigates that deep cervical flexor muscles impairments have been revealed in testing craniocervical flexion action in patients with cervicogenic headache.

Shaun P.O'Leary et al [2008][18]

The researcher describes the craniocervical flexion test could be describing as at least for neuromotor control. It is clinical test for the anatomical action of deep cervical flexor muscles, longus capitii and colli. Craniocervical flexion test will provide the nature of impairments associated with cervical musculoskeletal disorders and development of appropriate exercise intervention.

Michael Von Mengersen et al [2005][19]

This study sought to ascertain the usefulness of the clinical craniocervical flexion test to osteopathies in the clinical settings. The test was found to have excellent intra-rater and good inter-rater reliability.

2.8 OUTCOME MEASURE TOOL - UTHSCA SOFTWARE VERSION. 3.

Fatma A. El- Hamalawy et al [2011][27]

In this study evaluate the postural compensations and subjective complaints due to backpack loads. He assessed the biomechanical response to backpack loads such as forward head position, forward trunk lean and changes in gait. He evaluates the forward head posture of the samples by measuring craniovertebral angle through their digital photographs which can feed into image tool version. 3 proposed by University of Texas Health Science Center at San Antonio [UTHSCA]. The author concluded that the samples were demonstrated the increased forward head posture while carrying the loaded backpacks.

Zubia Veqar et al [2015][28]

Here, the researcher analyses the photographs using UTHSCA image tool program [developed at University of Texas Health Science Center at San Antonio, Texas.] on a HP versus 15 computers to measure craniovertebral angle and sagittal head tilt angle.

Frances Kistner et al [2013][29]

They analyses the postural angles by taking digital photographs of the left sided profile [sagittal view] of the participants, the postural angles examined in this study are craniovertebral angle, forward trunk lean and pelvic tilt.To measure these angles through digital photographs, adhesive reflective markers were placed by an experienced physical therapist on the C_7 spinous process and on the left side of the body on the tragus of the ear. After the data collection session were analyzed to obtain angle values [in degrees] by using image tool version. 3 [UTHSCA].

3. METHODOLOGY

3.1 RESEARCH DESIGN:

Quasi experimental study design.

3.2 STUDY POPULATION:

Patients with cervicogenic headache.

3.3 SAMPLING TECHNIQUE:

Non probability purposive sampling.

3.4 SAMPLE SIZE:

30 samples: 15 in each group.

- Experimental group [group A] - 15 patients
- Control group [group B] - 15 patients.

3.5 STUDY DURATION:

1½ years.

3.6 STUDY SETTING:

Department of physical medicine and rehabilitation, Kovai Medical Center and Hospital, Coimbatore.

3.7 STUDY CRITERIA:

3.7.1 Inclusion criteria:

- Patients with cervicogenic headache, confirmed by "the cervicogenic headache international study group diagnostic criteria" [sjaasted et al in 1998].
- Age limit: 20-45 years.

- Both genders are involved.
- Frequency of cervicogenic headache – at least once per week over period of 2 months or more.
- Unilateral headache'
- Poor performance in craniocervical flexion test – unable to control more than 2^{nd} stage.
- Patients who have craniovertebral angle $<42^0$.

3.7.2 Exclusion criteria:

- Features suggesting migraine & tension type headache.
- Bilateral headache.
- Hemicrania Continua.
- Cluster headache.
- Chronic paroxysmal hemicranias.
- Headache attributed to trauma or injury to the head and/or neck.
- Headache attributed to cranial or cervical vascular disorder.
- Headache attributed to non-vascular intracranial disorder.
- Headache attributed to a substance or its withdrawal.
- Headache attributed to infection.
- Headache attributed to psychiatric disorder.
- Painful cranial neuropathies and other facial pains.
- Headache or facial pain attributed to disorder of the cranium, eyes, ears, nose, sinuses, teeth, mouth or other facial structure.
- Good performance in craniocervical flexion test.
- Previous cervical spine surgery.
- Degenerative cervical pathologies.
- Other concomitant illness.
- Those who underwent previous physical therapy during last 6 months for cervical pain.

3.8 HYPOTHESIS:

3.8.1 Null hypothesis:

H_{01} There is no significant effect of retraining co-ordination of cervical muscles on verbally administered numerical rating scale in patients with cervicogenic headache.

H_{02} There is no significant effect of retraining co-ordination of cervical muscles on frequency of headache during a month in patients with cervicogenic headache.

H_{03} There is no significant effect of retraining co-ordination of cervical muscles on craniovertebral angle in patients with cervicogenic headache.

H_{04} There is no significant effect of retraining co-ordination of cervical muscles on craniocervical flexion test in patients with cervicogenic headache.

H_{05} Retraining of cervical muscles with medication has no significant effect in treatment of cervicogenic headache than medication alone

3.8.2 Alternate hypothesis:

H_{A1} There is a significant effect of retraining co-ordination of cervical muscles on verbally administered numerical rating scale in patients with cervicogenic headache.

H_{A2} There is a significant effect of retraining co-ordination of cervical muscles on frequency of headache during a month in patients with cervicogenic headache.

H_{A3} There is a significant effect of retraining co-ordination of cervical muscles on craniovertebral angle in patients with cervicogenic headache.

H_{A4} There is a significant effect of retraining co-ordination of cervical muscles on craniocervical flexion test in patients with cervicogenic headache.

H_{A5} Retraining of cervical muscles with medication has significant effect in treatment of cervicogenic headache than medication alone.

3.9 OUTCOME MEASURES:

- Verbally administered numerical rating scale.
- Frequency of cervicogenic headache during a month.
- Craniovertebral angle.
- Craniocervical flexion test.

3.10 MATERIALS USED:

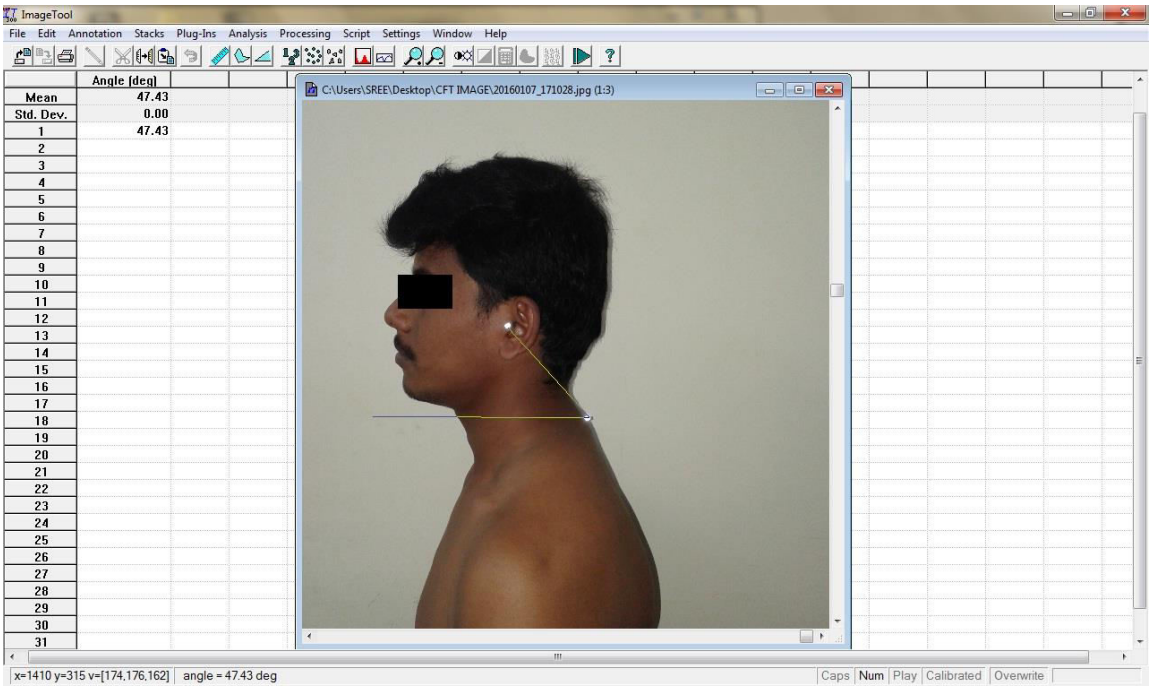
- Air filled sensor.
- Image tool version 3. [UTHSCA]
- Towel.
- Frequency of cervicogenic headache chart.

3.11 PROCEDURE:

Participants were recruited by referral from consulting physician of KMCH, Coimbatore. The patients who meet the study criteria and showed willingness to participate in this study were signed the informed consent form were included for this study. And they were assigned to either experimental group [group A] or the control group [group B] using purposive sampling technique.

Anesthetic blockades were not used as a criterion for cervicogenic headache as the procedure considered too invasive and costly for this study and is not readily assessable to most clinicians in outpatient department setups. Usual medications were not withheld from any participants for this study.

Pretest measured of verbally administered numerical rating scale, frequency of cervicogenic headache for a month, craniovertebral angle, craniocervical flexion test were taken prior to intervention. For measuring craniovertbral angle the photographs were taken and then fed into the image tool version 3 proposed by University of Texas Health Science Center at San Antonio [UTHSCA] and the images were saved.



Experimental groups were received exercises to retrain the coordination of cervical muscles and postural re-education along with medication.. The participants in this were taught exercises on day 1 and they were asked to continue the same at home as

home exercise program. Intervention pamphlets were provided in their language with illustrations to carry out the exercises effectively. They were also asked to document the exercise sessions in the tabular column provided to monitor their commitment to exercise. Patients were contacted once a week through phone to make sure they were continuing the exercises.

Control group was not provided with any treatment other than the medications. Posttest measures were taken after 4 weeks on their next visit to hospital or by arranging a meeting through phone call. The data that collected were statistically analyzed and conclusions are recorded.

3.11.1 INTERVENTION

Cervical muscle coordination retraining exercise protocol.

1. Training the holding capacity of deep neck flexors:

- This was done by using air filled sensor initially by placing it at the level of craniocervical junction in supine lying.
- Training was initiated at lowest levels of test. [20 or 22 mmHg]
- Patient attempts to node their head to reach the desired value of feedback.
- Patient was asked to hold steadily this position for 10 seconds without the obvious use of superficial neck flexors or any jerky craniocervical movements and then relax.
- When the patient masters in this exercise, the feedback is removed and a rolled towel is used at home as home exercise program.
- This was done by asking the patient to place a towel roll on back of neck and try to look at your great toe.
- Asked to hold this position for 10 seconds and then relax.
- Repeat this exercise for 7-10 times.

2. Retraining cervical spine extension in upright posture:

- Ask the patient to sit on a chair with back straight.
- The patient initiate cervical extension with chin lift slowly and within a range that is pain free which is able to be controlled.

- This was done by asking the patient to slowly lift your chin up and try looking at the celling until you feel a discomfort.
- This encourage patient to allow weight of the head to move backward and accept the challenge of gravity.
- And then return to the upright posture by bringing chin down first. [initiated by craniocervical flexion than the sternocleidomastoid muscle and other superficial muscles]
- Repeat this exercise for 7-10 times.

3. Extensors of craniocervical spine:

- Sit on a chair with back straight.
- Patients were instructed to flex the head and neck slowly, controlling the speed against gravity.
- And return to the neutral position without excessive chin poke to avoid excessive craniocervical extension.
- The aim of this exercise is to encourage the obliquely oriented sub occipital and craniocervical extensor muscles to contribute to the motion rather than the dominant pattern of large muscles such as splenius capitis and cervicis.
- Repeat this exercise for 7-10 times.

4. Co-ordination of the neck flexors and extensors:

- Sit on a chair with back straight.
- This exercise was performed by the patient using self-resisted isometric rotation.
- Ensure that the patient performs the occipital lift in correct postural position to pre-facilitate the activation of the longus colli before adding the gentle resistance.
- For this ask the patient to do a stable nodding movement.
- Then instruct the patient to place the palm on the side of face and try to look in to the palm providing the resistance as a facilitating procedure for 10 seconds and then relax.

- The patient performs the alternating rhythmic stabilization exercise with an emphasis on slow onset and slow release holding contraction, using resistance of 10-20% effort.
- Repeat this exercise for 7-10 times.

5. Retraining scapular orientation in posture:

- The aim of this exercise was to facilitate the co-ordinated action of all part of the trapezius and serratus anterior by allowing lower trapezius to slightly depress the medial border of scapula, consequently lengthening the levater scapulae.
- Sit on a chair with back straight and placing both hands on your thigh.
- Ask the patient to pull their shoulders backward and hold this position.
- To encourage the contribution of serratus anterior, instruct the patient to gently press down on their thighs with their hands.
- Hold this position for 10 seconds and then relax.
- Repeat this exercise for 7-10 times.

6. Training the endurance capacity of the scapular stabilizers:

- Perform this exercise in prone lying against the effect of gravity.
- Now pull your shoulders backwards.
- Hold it for 10 seconds and then relax.
- Repeat this exercise for 7-10 times.

7. Re-education in posture:

- Postural position was trained in sitting with close to a wall while supporting back on the wall and is corrected from the pelvis.
- First patients want to draw their pelvis up to an upright neutral position by asking to press on the wall with back such that there are fewer gaps between the back and wall and hold it. [Formation of low lumbar lordosis and activation of lumbar multifidus.]
- Ensure the correct position of the lumbopelvic region not with thoracolumbar extension.

- Now pull both shoulders backwards such that there are fewer gaps between the shoulder and wall and hold it.
- Then perform a gentle nodding movement of the head.
- Hold this position for 10 seconds and then relax.
- Repeat this exercise for 7-10 times.

Note:

- Perform one session of exercise every day, for 4 weeks.
- Should not hold breath while doing any of these exercises. Because it will build up tension in the body and inhibit the supply of oxygen to the muscles, thus it reduces the performance of the muscles.
- If you feel any discomfort during the exercise, stop the exercise.

3.11.2 INTERVENTION DURATION:

The intervention duration was 4 weeks in which the patient perform the exercises.

3.12 PHOTOGRAPHIC PRESENTATION:

FIGURE 1 CERVICAL MUSCLE RETRAINING EXERCISE

FIGURE 2: RETRAINING CERVICAL SPINE EXTENSION IN UPRIGHT POSTURE

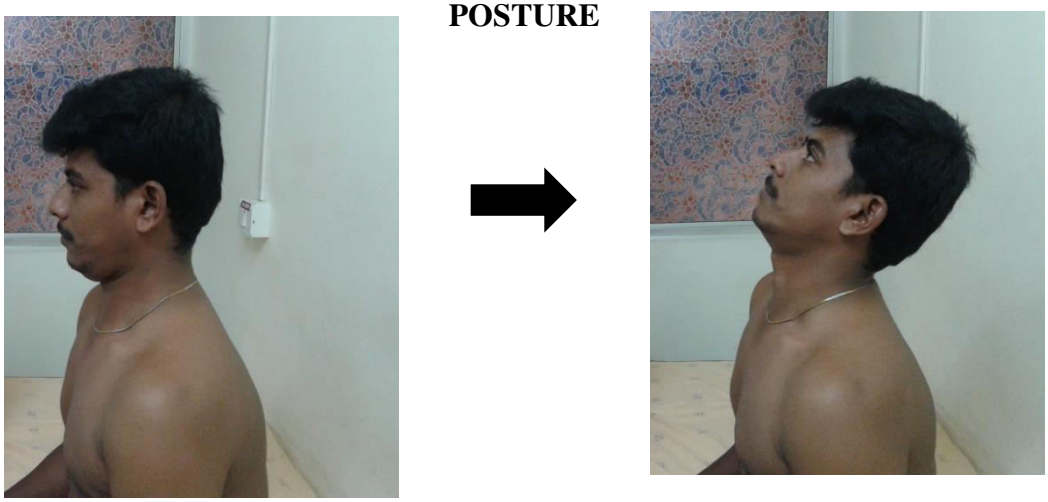


FIGURE 3: EXTENSORS OF CRANIOCERVICAL SPINE

FIGURE 4: CO-CONTRACTION OF THE NECK

FIGURE 5: RETRAINING SCAPULAR MUSCLES

FIGURE 6: TRAINING ENDURANCE CAPACITY OF SCAPULAR STABILIZATION

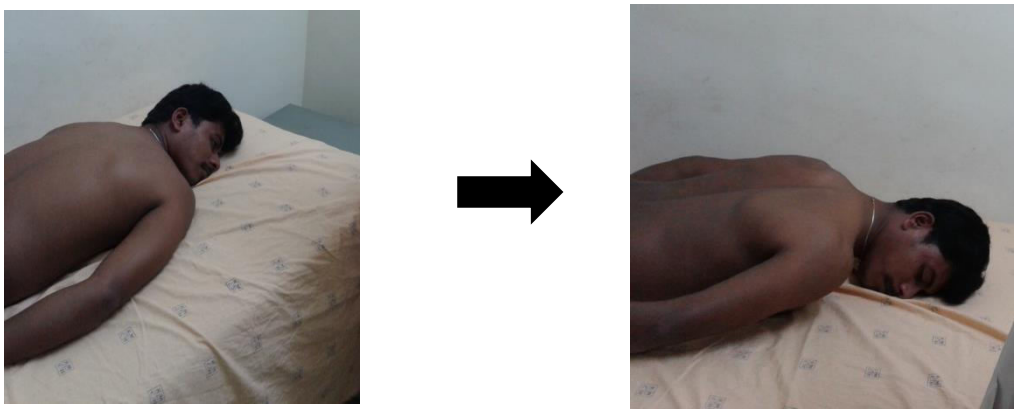


FIGURE 7: RE-EDUCATION OF POSTURE

3.13 STATISTICAL ANALYSIS:

a) **Paired 't' test**

b) **Independent 't' test**

PAIRED `t' TEST (within groups)

- Post-test values of the study are collected and assessed for variation in each group and their results are analyzed using paired 't' test.

$$\mathbf{t} = \frac{\bar{d}\sqrt{n}}{S} \qquad \text{where, } \mathbf{S} = \sqrt{\frac{\sum d^2 - \left|\bar{d}\right|^2 \times n}{n-1}}$$

INDEPENDENT `t' TEST (between groups)

$$t = \frac{\overline{X1} - \overline{X2}}{S}\sqrt{\frac{n_1 n_2}{(n_1+n_2)}} \qquad \text{Where, } S = \sqrt{\frac{\sum d_1^2 + \sum d_2^2}{n_1 + n_2 - 2}}$$

- **S** = Combined standard deviation
- $\mathbf{d_1}$ **&** $\mathbf{d_2}$ = difference between initial and final readings in group A & B
- $\mathbf{n_1}$ **&** $\mathbf{n_2}$= number of patients in group A & group B
- $\mathbf{X_1}$ **&** $\mathbf{X_2}$ = mean of group A & group B

4. DATA PRESENTATION

4.1 TABULAR PRESENTATION

PAIRED 't' TEST

OUTCOME MEASURES		MEAN VALUE		CALCULATED 't' VALUE	TABLE 't' VALUE	LEVEL OF SIGNIFICANCE
		PRE TEST	POST TEST			
Verbally administered numeric rating scale	Group A	**7.86**	**3.46**	**17.30**	**2.14**	**P<0.05 Significant**
	Group B	**8.06**	**5.13**	**12.86**	**2.14**	**P<0.05 Significant**
Frequency of headache	Group A	**17.66**	**5.8**	**22.99**	**2.14**	**P<0.05 Significant**
	Group B	**17.26**	**9.33**	**17.13**	**2.14**	**P<0.05 Significant**
Craniover-tebral angle	Group A	**37.41**	**44.54**	**14.32**	**2.14**	**P<0.05 Significant**
	Group B	**37.91**	**40.35**	**11.02**	**2.14**	**P<0.05 Significant**
Craniocer-vical flexion test	Group A	**25.33**	**68**	**19.49**	**2.14**	**P<0.05 Significant**
	Group B	**24.53**	**47.73**	**9.84**	**2.14**	**P<0.05 Significant**

INDEPENDENT ‘t’ TEST

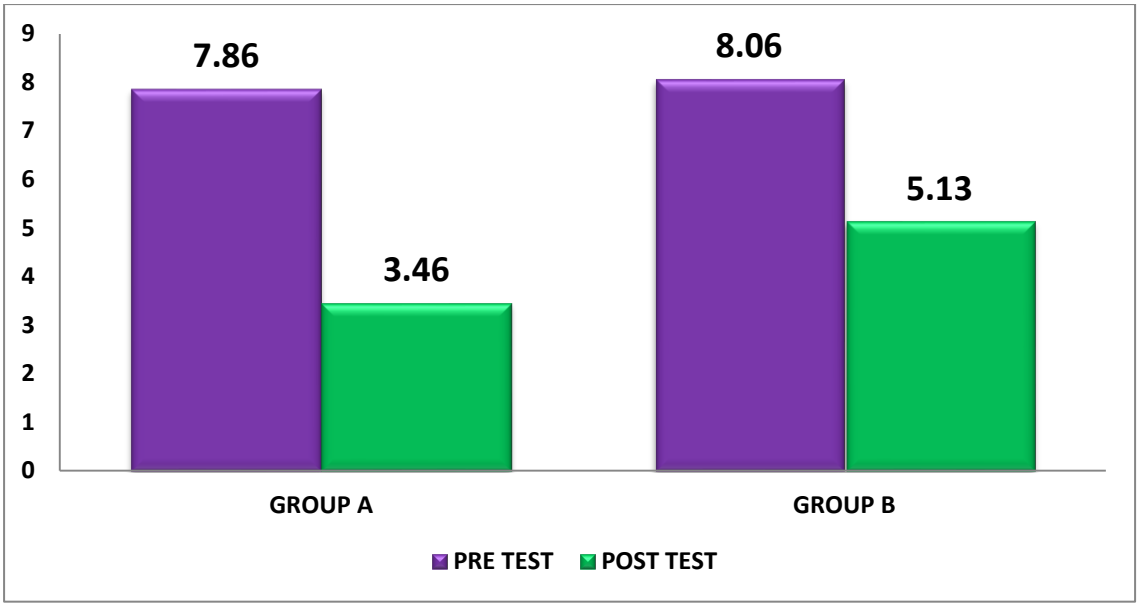
OUTCOME MEASURES		MEAN VALUE		CALCULATED ‘t’ VALUE	TABLE ‘t’ VALUE	LEVEL OF SIGNIFICANCE
		GROUP A	GROUP B			
Verbally administered numeric rating scale	Pre test	**7.86**	**8.06**	**0.63**	**2.048**	**p>0.05 not significant**
	Post test	**3.46**	**5.13**	**7.187**	**2.048**	**P<0.05 significant**
Frequency of headache	Pre test	**17.66**	**17.26**	**0.65**	**2.048**	**p>0.05 not significant**
	Post test	**5.8**	**9.33**	**8.23**	**2.048**	**P<0.05 significant**
Craniovertebral angle	Pre test	**37.42**	**37.91**	**0.15**	**2.048**	**p>0.05 not significant**
	Post test	**44.5**	**40.35**	**4.119**	**2.048**	**P<0.05 significant**
Craniocervical flexion test	Pre test	**25.33**	**24.53**	**0.433**	**2.048**	**p>0.05 not significant**
	Post test	**68**	**47.73**	**7.36**	**2.048**	**P<0.05 significant**

4.2 GRAPHICAL PRESENTATION

PAIRED 't' TEST

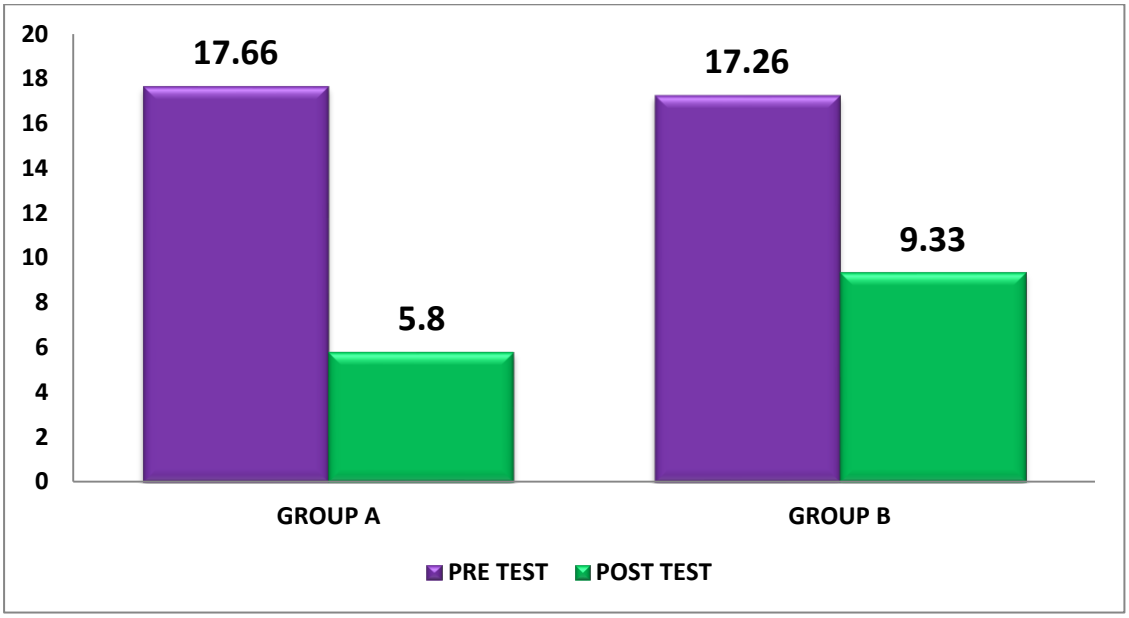
4.2.1 Pre test & Post test mean values of verbally administered numeric rating scale in Group A & Group B

GROUP A = EXPERIMENTAL GROUP GROUP B = CONTROL GROUP



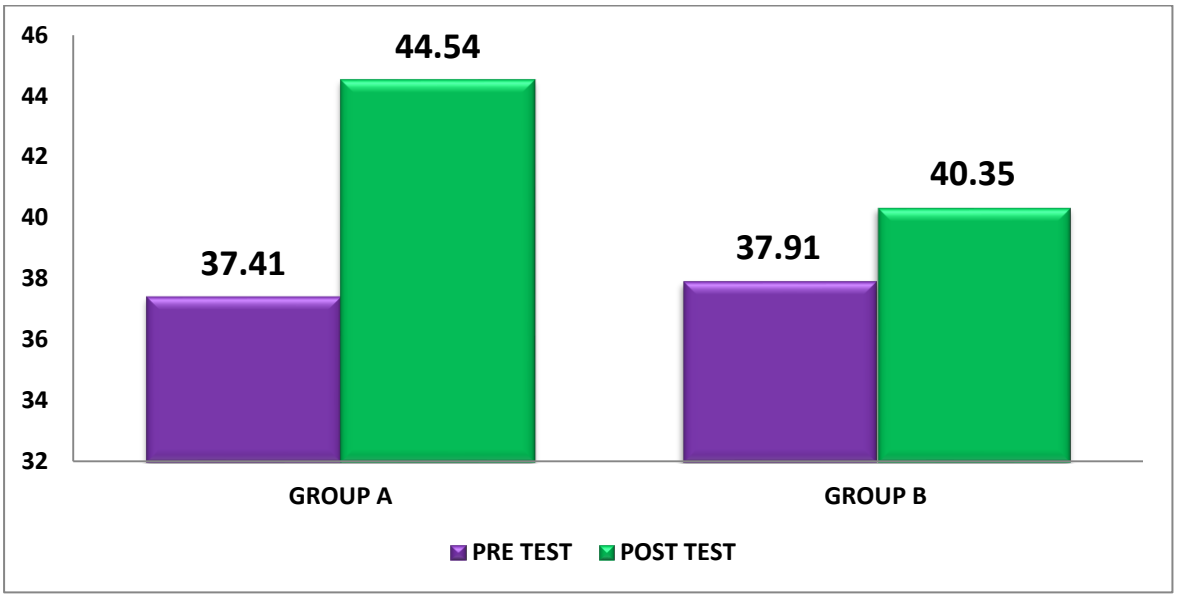
4.2.2 Pre test & Post test mean values of frequency of headache in GROUP A & GROUP B

GROUP A = EXPERIMENTAL GROUP GROUP B = CONTROL GROUP



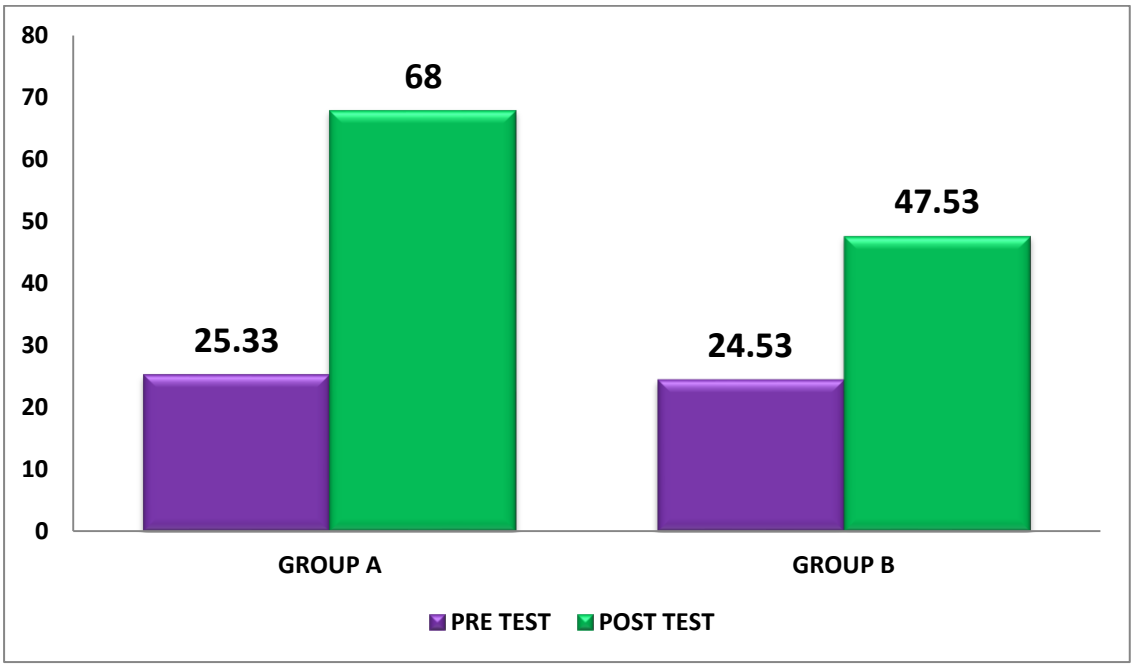
4.2.3 Pre test & Post test mean values of craniovertebral angle in Group A & Group B

GROUP A = EXPERIMENTAL GROUP GROUP B = CONTROL GROUP



4.2.4 Pre test & Post test mean values of craniocervical flexion test in Group A & Group B

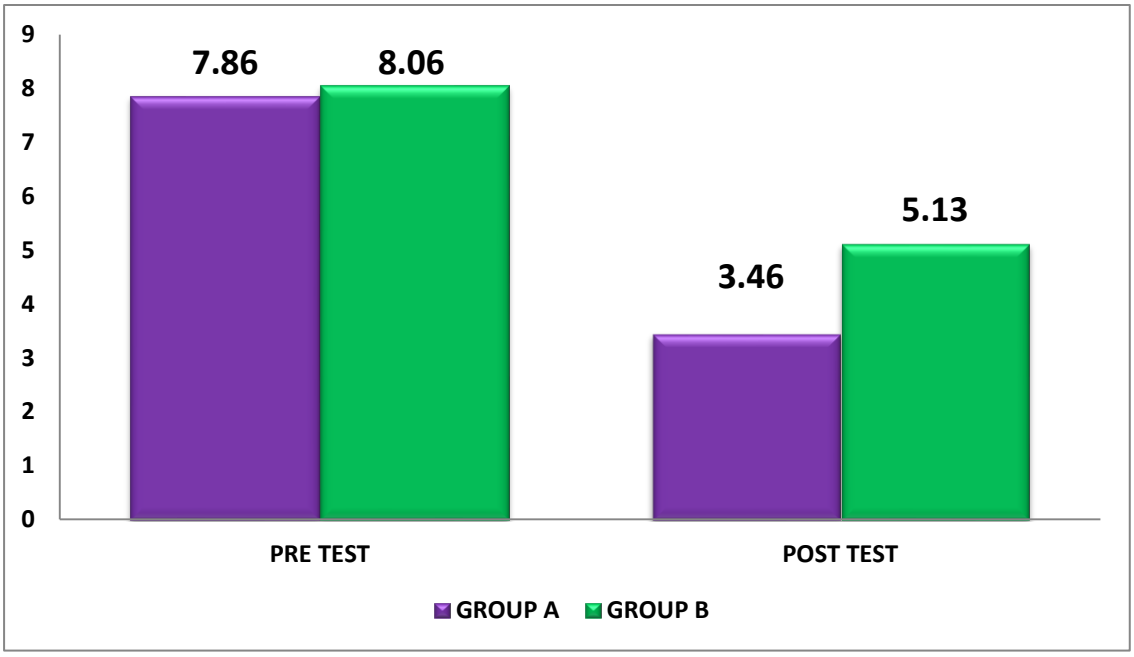
GROUP A = EXPERIMENTAL GROUP GROUP B = CONTROL GROUP



INDEPENDENT 't' TEST

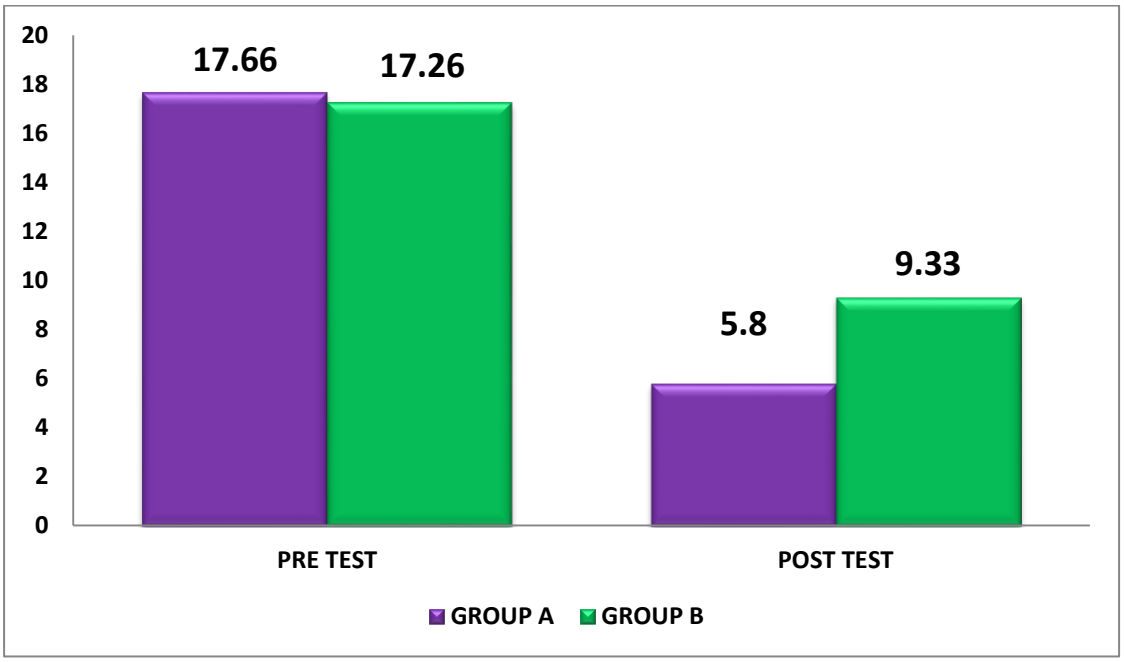
4.2.5 Pre test & Post test mean values of verbally administered numeric rating scale for Group A & Group B

GROUP A – EXPERIMENTAL GROUP GROUP B – CONTROL GROUP



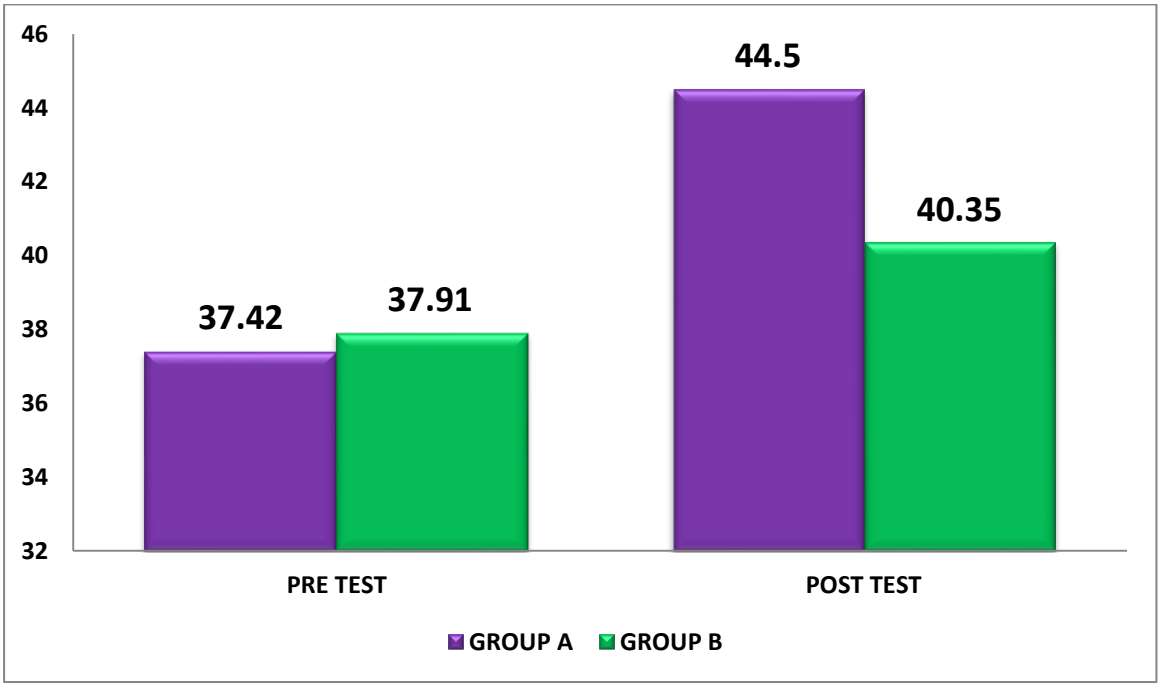
4.2.6 Pre test & Post test mean values of frequency of headache for Group A & Group B

GROUP A – EXPERIMENTAL GROUP GROUP B – CONTROL GROUP



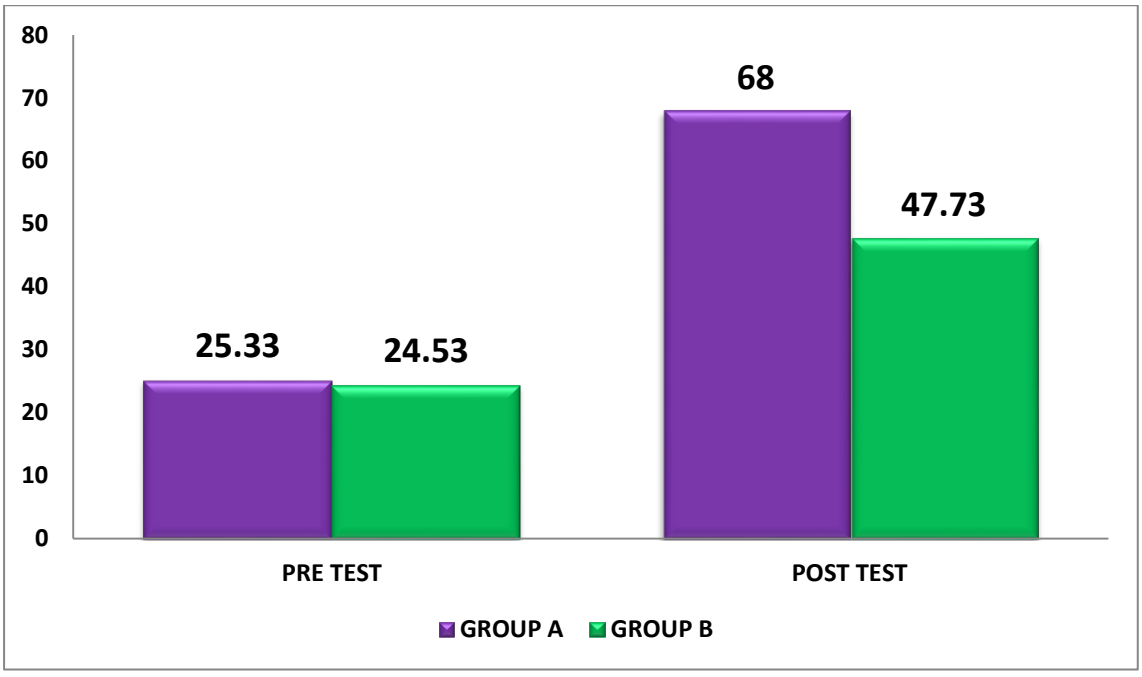
4.2.7 Pre test & Post test mean values of cranio vertabral angle for both Group A & Group B

GROUP A = EXPERIMENTAL GROUP GROUP B = CONTROL GROUP



4.2.8 Pre test & Post test mean values of craniocervical flexion test for both Group A & Group B

GROUP A = EXPERIMENTAL GROUP GROUP B = CONTROL GROUP



5. DATA ANALYSIS AND RESULTS

Thirty subjects completed the study; fifteen in each group and the parameters are verbally administered numeric rating scale for pain, frequency of headache to find out the cervicogenic headache frequency before and after the treatment, craniovertebral angle for measuring the forward head posture and craniocervical flexion test to find out the level of deep cervical muscle strength were assessed and analyzed. The statistical analysis were done using paired 't' test and independent 't' test with 5% of level of significance.

PAIRED 't' TEST:

VERBALLY ADMINISTERED NUMERIC RATING SCALE.

Group A [cervical muscle coordination retraining exercises with medication]

The pre-test and post-test values of verbally assisted numeric rating scale was analyzed using paired't' test. For 14 degrees of freedom at 5% level of significance the table't' value was 2.145 and the calculated 't' value was 17.30. Since the calculated 't' value was greater than the table't' value, null hypothesis was rejected. Hence, there was significant reduction in verbally administered numeric rating scale in group A.

Group B [medication alone]

The pre-test and post-test values of verbally assisted numeric rating scale was analyzed using paired't' test. For 14 degrees of freedom at 5% level of significance the table 't' value was 2.145 and the calculated 't' value was 12.865. Since the calculated 't' value was greater than the table't' value, null hypothesis was rejected. Hence, there was significant reduction in verbally administered numeric rating scale in group B.

FREQUENCY OF HEADACHE.

Group A

The pre-test and post-test values of frequency of headache was analyzed using paired‘t’ test. For 14 degrees of freedom at 5% level of significance the table ‘t’ value was 2.145 and the calculated ‘t’ value was 22.99. Since the calculated ‘t’ value was greater than the table‘t’ value, null hypothesis was rejected. Hence, there was significant reduction in frequency of headache in group A.

Group B

The pre-test and post-test values of frequency of headache was analyzed using paired‘t’ test. For 14 degrees of freedom at 5% level of significance the table ‘t’ value was 2.145 and the calculated ‘t’ value was 17.13. Since the calculated ‘t’ value was greater than the table‘t’ value, null hypothesis was rejected. Hence, there was significant reduction in frequency of headache in group B.

CRANIOVERTEBRAL ANGLE.

Group A

The pre-test and post-test values of craniovertebral angle was analyzed using paired‘t’ test. For 14 degrees of freedom at 5% level of significance the table ‘t’ value was 2.145 and the calculated ‘t’ value was 14.322. Since the calculated ‘t’ value was greater than the table‘t’ value, null hypothesis was rejected. Hence, there was significant improvement in craniovertebral angle in group A.

Group B

The pre-test and post-test values of craniovertebral angle was analyzed using paired‘t’ test. For 14 degrees of freedom at 5% level of significance the table ‘t’ value was 2.145 and the calculated ‘t’ value was 11.02. Since the calculated ‘t’ value was greater than the table ‘t’ value, null hypothesis was rejected. Hence, there was significant improvement in craniovertebral angle in group B.

CRANIOCERVICAL FLEXION TEST.

Group A

The pre-test and posttest values of craniocervical flexion test was analyzed using paired ‘t’ test. For 14 degrees of freedom at 5% level of significance the table ‘t’ value was 2.145 and the calculated ‘t’ value was 19.493. Since the calculated ‘t’ value was greater than the table ‘t’ value, null hypothesis was rejected. Hence, there was significant improvement in craniocervical flexion test in group A.

Group B

The pre-test and post-test values of craniocervical flexion test was analyzed using paired ‘t’ test. For 14 degrees of freedom at 5% level of significance the table ‘t’ value was 2.145 and the calculated ‘t’ value was 9.844. Since the calculated ‘t’ value was greater than the table ‘t’ value, null hypothesis was rejected. Hence, there was significant improvement in craniocervical flexion test in group B.

INDEPENDENT ‘t’ TEST:

VERBALLY ADMINISTERED NUMERIC RATING SCALE.

Pre test values

The pre-test values of group A and group B was analyzed using independent‘t’ test. For 28 degrees of freedom at 5% level of significance, the table ‘t’ value was 2.048 and the calculated ‘t’ value was 0.63. Since the calculated ‘t’ value was less than the table‘t’ value . Hence, there was no significant reduction in verbally administered numeric rating scale in both group A and B.

Post test values

The post-test values of group A and group B was analyzed using independent‘t’ test. For 28 degrees of freedom at 5% level of significance, the table ‘t’ value was 2.048 and the calculated ‘t’ value was 7.187. Since the calculated ‘t’ value was greater than the table‘t’ value null hypothesis was rejected. Hence, there was

significant reduction in verbally administered numeric rating scale in both group A and B.

FREQUECY OF HEADACHE.

Pre test values

The pre-test values of group A and group B was analyzed using independent 't' test. For 28 degrees of freedom at 5% level of significance, the table 't' value was 2.048 and the calculated 't' value was 0.65. Since the calculated 't' value was less than the table't' value null hypothesis was accepted. Hence, there was no significant reduction in frequency of headache in both group A and B.

Post test values

The post-test values of group A and group B was analyzed using independent't' test. For 28 degrees of freedom at 5% level of significance, the table 't' value was 2.048 and the calculated 't' value was 8.23. Since the calculated 't' value was greater than the table't' value null hypothesis was rejected. Hence, there was significant reduction in frequency of headache in both group A and B.

CRANIOVERTEBRAL ANGLE.

Pre test values

The pre-test values of group A and group B was analyzed using independent't' test. For 28 degrees of freedom at 5% level of significance, the table 't' value was 2.048 and the calculated 't' value was 0.15. Since the calculated 't' value was less than the table't' value null hypothesis was accepted. Hence, there was no significant improvement in craniovertebral angle in both group A and B.

Post test values

The post-test values of group A and group B was analyzed using independent 't' test. For 28 degrees of freedom at 5% level of significance, the table 't' value was 2.048 and the calculated 't' value was 4.119. Since the calculated 't' value was greater than the table't' value null hypothesis was rejected. Hence, there was significant improvement in craniovertebral angle in both group A and B.

CRANIOCERVICAL FLEXION TEST.

Pre test values

The pre-test values of group A and group B was analyzed using independent‘t’ test. For 28 degrees of freedom at 5% level of significance, the table ‘t’ value was 2.048 and the calculated ‘t’ value was 0.433. Since the calculated ‘t’ value was less than the table‘t’ value null hypothesis was accepted. Hence, there was no significant improvement in craniocervical flexion test in both group A and B.

Post test values

The post-test values of group A and group B was analyzed using independent‘t’ test. For 28 degrees of freedom at 5% level of significance, the table ‘t’ value was 2.048 and the calculated ‘t’ value was 7.368. Since the calculated ‘t’ value was greater than the table‘t’ value null hypothesis was rejected. Hence, there was significant improvement in craniocervical flexion test in both group A and B.

6. DISCUSSION

Cervicogenic headache with musculoskeletal causes are classified as secondary type headache by international headache society. It is more prevalent type of headache where patient is affected physically, economically and recreationally. Cervicogenic headache refers to headache caused by a disorder of cervical spine and its component bony, disc and/or soft tissue elements, usually but not invariably accompanied by neck pain.

The forward head posture in cervicogenic headache patients causes more strain over neck, muscle damage [especially cervical muscles] and pain. For every inch that the head moves forward it has the effects of adding 10 pounds of perceived weight. So if head weighs 12 pounds and it moves forward 2 inches, it's as if your head now weighs 32 pounds. The muscles of cervical area will have a constant added strain.

The forward head posture leads to alter the values of craniocervical flexion test and craniovertebral angle from normal range. This also indicates the presence of deep cervical muscle weakness and pain. This has been show in various literature that there is a relationship exist between deep cervical muscle coordination and forward head posture in cervicogenic headache patients.

This study emphasized on the three impairments in cervicogenic headache: forward head posture, deep cervical muscle weakness and pain. Through medications we can reduce the pain and relaxing the muscles. So along with the medication, cervical muscle coordination retraining exercise programs with the existing literature support got a significant improvement in outcome results.

Patients from both the interventional groups showed reduction in intensity and frequency of pain. This result was not much of statistical differences. Since that both the groups had significant pain relief following the treatment.

The goals of cervical muscle coordination training exercises, is improving the cervical muscle strength and correcting the forward head posture. In this study, the patients who received this intervention were instructed to do the exercises with

concentration over the movements without holding the breath. Holding the breath will build up tension in the body and inhibit the supply of oxygen to the muscles and thus reduces the performances of the muscles. From the result that obtained from this study, exercises along with medication group showed greater improvement in craniovertebral angle and craniocervical flexion test than the patient in medication group.

From the results of this 4 weeks treatment study, it is recommended that cervical muscle coordination retraining exercises along with medication as a superior intervention for correcting the head posture, reducing intensity and frequency of pain and improving cervical muscle strength in cervicogenic headache patients and therefore reduces the musculoskeletal discomfort.

7. SUMMARY AND CONCLUSION

This study was done to find out the effects of cervical muscle coordination retraining exercises and medications in pain reduction, improving cervical muscle strength and postural correcting cervicogenic headache patients. The effects were studied with the intensity and frequency of headache, measuring the forward headache posture and cervical muscles strength.

After the initial screening 30 patients satisfied the inclusion criteria, an informed consent was obtained from them. Then these 30 patients were allotted into 2 groups. They are cervical muscle coordination retraining exercises along with medication group and medication group.

The outcome measures used for this study were verbally administered numeric rating scale, frequency of headache, craniocervical angle and craniocervical flexion test. Outcomes were taken before and after the treatment for 30 patients who were taken for this study. The craniovertebral angle was measured by using image tool version 3 [UTHSCA].

Statistical analysis were done using the paired ‘t’ test with 5% level of significance. It was found that in both the groups there were significant improvement in head posture and a considerable change in the cervical muscles strength.

Independent ‘t’ test was used to find out the difference between both the groups. There were no much differences in pain between groups. Although comparing the forward head posture and cervical muscle strength there is a greater improvement in exercises along with medication group than the medication group.

The mean value of both groups shows that exercises along with medication group shows better improvement than medication group.

Hence from result of this study suggested that while treating a patient with cervicogenic headache who has a considerable cervical muscle weakness, forward head posture and pain; cervical muscle coordination retraining exercises along with medication can be used as it shows a greater reduction of pain and also considerable improvement in cervical muscle strength and head posture.

8. LIMITATIONS AND SUGGESTIONS

- This study has been done with smaller samples and therefore the results cannot be generalized. Hence larger sample is recommended for future studies.
- Less duration of 4 weeks follow up was done in this study. Hence long term follow up can be considered in future studies.
- In future studies samples can also selected from other age groups.
- In this study the participants were given only the home based exercise program. It is suggested that exercise program can be given under the therapist's supervision.
- Deep cervical muscle incoordination and forward head posture are taken as a major contribution of cervicogenic headache in this study; studies can be done by taking into consideration of other causative factors.
- This study, did not include the progression of deep cervical exercise and hence further studies done with progression of exercise could yield more emphatic results.

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Appendices

APPENDIX - 1

INFORMED CONSENT FORM

I……..voluntarily consent to participate in the research study , **"EFFECT OF CERVICAL MUSCLES CORDINATION RETRAINING EXERCISES ON PAIN REDUCTION AND POSTURAL CORRECTION IN PATIENTS WITH CERVICOGENIC HEADACHE."**

The researcher has explained me the treatment approach in brief, the risk of participation and has answered the questions related to the research to my satisfaction.

Signature of the participant **Signature of the researcher**

Signature of the witness

Place :

Date :

APPENDIX – 2

ASSESSMENT FORM

SUBJECTIVE EXAMINATION:

Name

Age

Sex

Address

Occupation

Date of assessment

On Examination

MEASUREMENT TOOLS

	Pre test	**Post test**
Verbally administered numeric rating scale		
Frequency of cervicogenic headache during a month		
Craniovertebral angle		
Craniocervical flexion test		

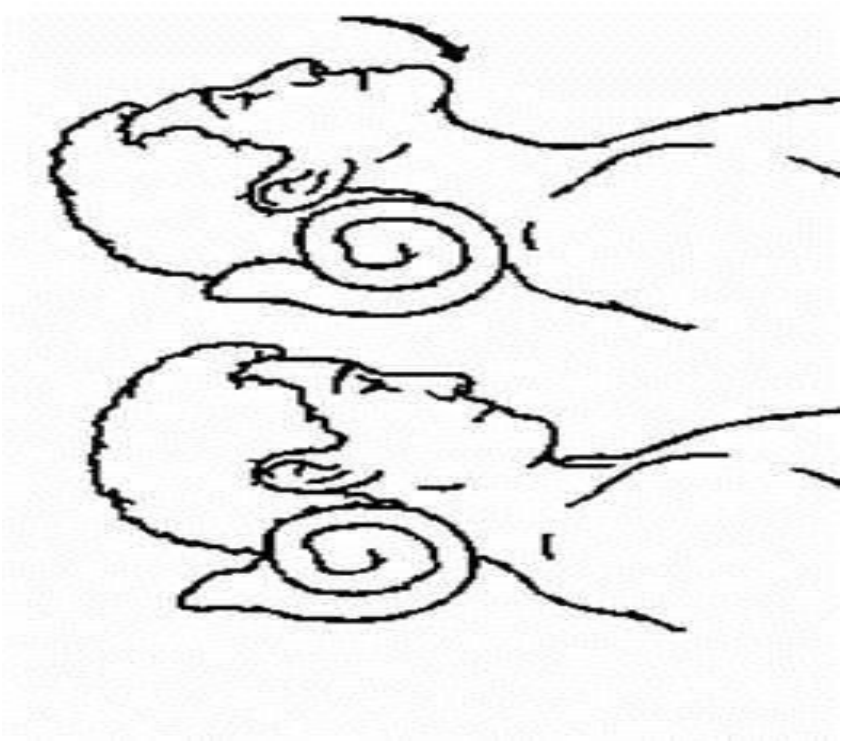
APPENDIX – 3

INTERVENTION PAMPHLET

CERVICAL MUSCLES RETRAINING EXERCISE

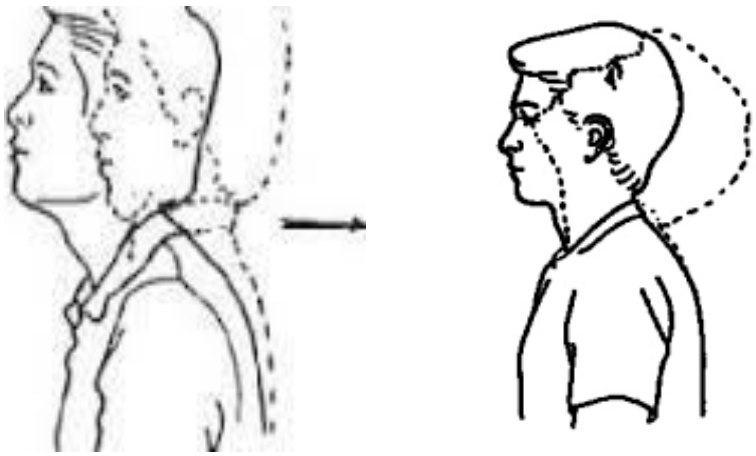
1) Training the holding capacity of deep neck flexors:
    - Lie down straight on the bed.
    - Place a towel roll at the back of your neck.
    - Now, try to look at your great toe.
    - Hold this position for 10 seconds and then release.
    - Repeat this exercise for 10 times.

- fl;bypd; Nky; Neuhf gLf;fTk;
- fOj;jpd; gpd;Gwkhf xU Jzp RUis itf;fTk;(gpd; jiyf;Fk; fOj;Jf;Fk; ,ilapy;)
- fhy; fl;iltpuiy ghh;f;f Kaw;rpj;jthNw 10 nehbfs; gpbj;J itf;fTk;.
- gpd;G tpl;L ,isg;ghuTk;
- ,t;thW 10 Kiw nra;aTk;.



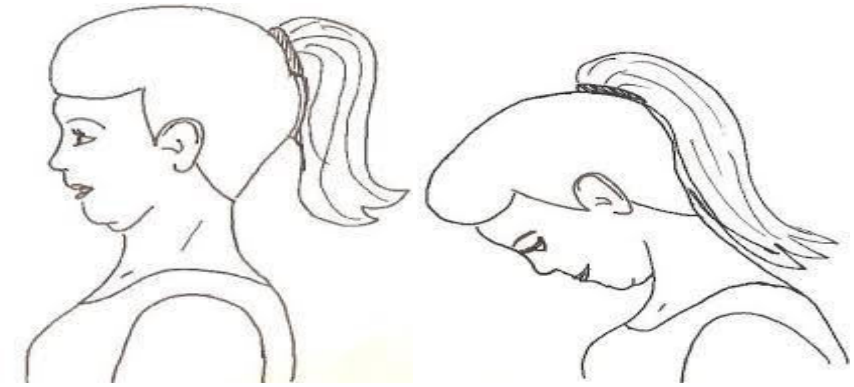
2) Re-training cervical spine extension in upright posture:
    - Sit down with your back straight.
    - Now, slowly lift your chin up, and try looking at the ceiling.
    - Continue the movement by trying to look further along the ceiling until you feel a discomfort.
    - And then return to the upright posture by bringing your chin down first.
    - Repeat this exercise for 10 times.

- KJif Neuhf itj;J cl;fhuTk;.
- jhilia J}f;fpathNw NkNy ghh;f;fTk;.
- mg;gbNa jiyia Kbe;j tiu gpd;dhy; tisf;fTk;.
- gpd;> nkJthf jhilia jho;j;jpathNw jiyia Neuhf;fTk;.
- ,t;thW 10 Kiw nra;aTk;.



3) Extensors of craniocervical spine:
    - Sit down with your back straight.
    - Flex your head and neck forwards and look down.
    - Flex it slowly, controlling the speed against gravity.
    - Now return to the neutral position without excessive chin poke.
    - Repeat this exercise for 10 times.

- KJif Neuhf itj;J cl;fhuTk;
- jiyiaAk; fOj;ijAk; Kd;Gwkhf tisj;J fPNo ghh;f;fTk;.
- ,ij nkJthfTk; epjhdkhfTk; nra;aTk;.
- gpd; jiyia epkph;j;jp Neuhf ghh;f;fTk;.
- ,t;thW 10 Kiw nra;aTk;.

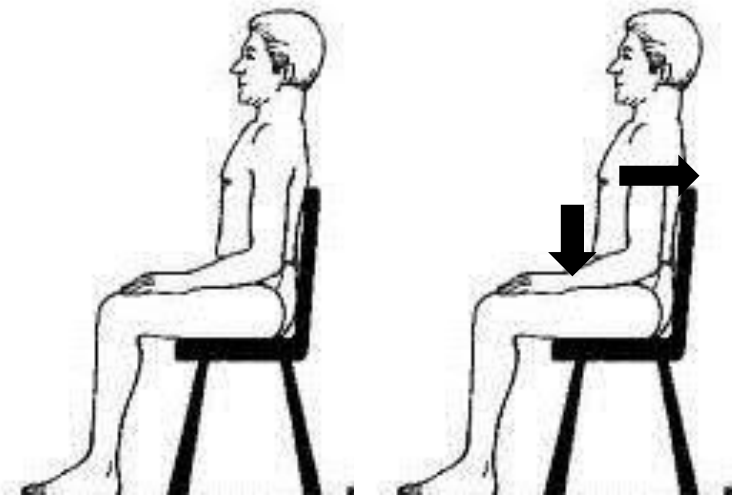


4) Co-contraction of the neck flexors and extensors:
    - Sit down with your back straight.
    - Do a stable nodding movement, just like how you did in first exercise.
    - Then place the palm of your hand on the side of your face.
    - Now try to looking into the palm [resist your turn with the palm]. Do not use too much of force.
    - Hold for 10 seconds and then relax.
    - Repeat this exercise for 10 times.

- KJif Neuhf itj;J cl;fhuTk;
- Kjyhk; gapw;rpapy; nra;jJ Nghy jiyia rpwpjsT mirj;J gpbf;fTk;.
- mt;thW gpbj;jthNw ifia fd;dj;jpy; itf;fTk;.
- gpd; if itj;Js;s gf;fkhf ghh;f;f Kaw;rpf;fTk;(if nfhz;L jLf;fTk;).
- gpd; gykhf js;s Ntz;Lk;.
- ,ij gj;J nehbfs; gpbj;j gpd; tplTk;.
- ,ij 10 Kiw nra;aTk;.

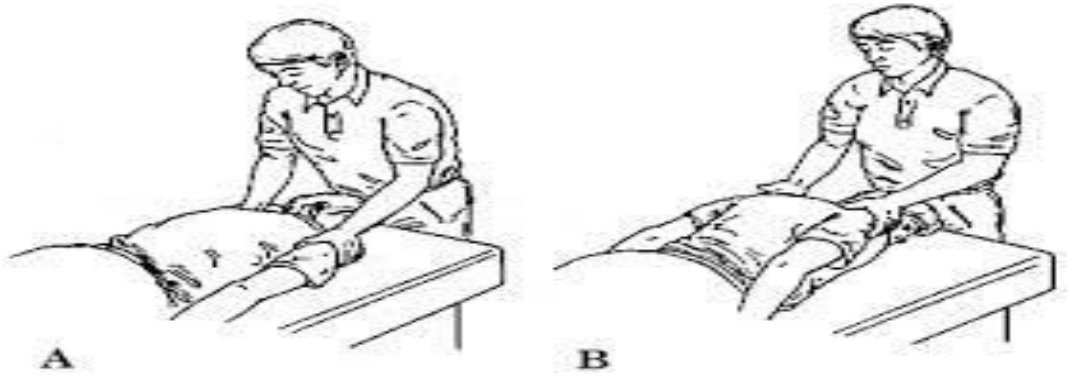
5) Retraining scapular muscles:
    - Sit down with your back straight with your palm on your thigh.
    - Now pull your shoulders backward and hold this position.
    - And gently press down on to your thigh with your hands.
    - Hold it for 10 seconds and relax.
    - Repeat this exercise for 10 times.

- KJif Neuhf itj;J cl;fhuTk;. ,U iffisAk; njhilapd; Nky; itf;fTk;.
- ,U Njhs;gl;ilfisAk; gpd;Gwkhf ,Oj;Jg; gpbf;fTk;.
- gpd; ,U iffisAk; nkJthf njhilapd; Nkyk; mOj;jTk;.
- 10 nehbfs; gpbj;jgpd; tpl;L ,isg;ghuTk;
- ,ij 10 Kiw nra;aTk;.



6) Training endurance capacity of scapular stabilization:
    - Lie down on your stomach.
    - Now pull your shoulder backwards and hold it for 10 seconds and relax.
    - Repeat this exercise for 10 times.

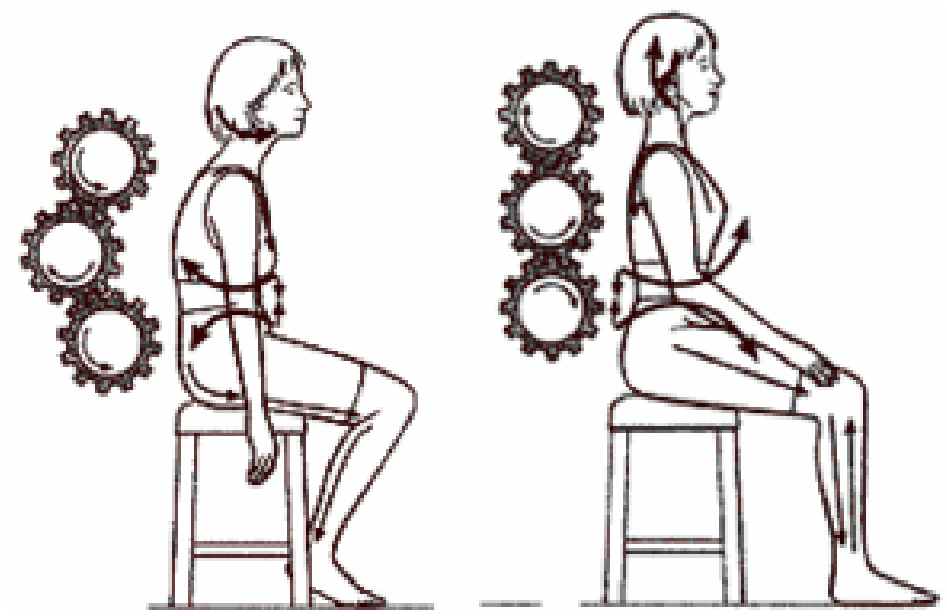
- ftpo;e;J gLf;fTk;.
- ,U Njhs; gl;ilfisAk; gpd;Gwkhf J}f;fp gpbf;fTk;
- 10 nehbfs; gpbj;jgpd;> tpl;L ,isg;ghuTk;.
- 10 Kiw ,ij kPz;Lk; nra;aTk;.



7) Re-education of posture:
    - Sit close to a wall while supporting your back on the wall.
    - Press on the wall with your back such that there is less gap between the back and the wall and hold it.
    - Now pull your shoulders backwards such that there is less gap between the shoulder and the wall and hold it.
    - Then perform a gentle nodding movement of the head and hold this position.
    - Repeat this exercise for 10 times.

- Rthpy; rha;e;jgb cl;fhuTk;.
- KJif Rthpy; mOj;jp gpbf;fTk;(RtUf;Fk; KJFf;Fk; cs;s ,ilntsp FiwaNtz;Lk;).

- gpd; Njhs;gl;ilfis gpd;Gwkhf ,Oj;Jg; gpbf;fTk;.
- mt;thW gpbj;jthNw Kjyhk; gapw;rpapy; nra;jJ Nghy jiyia rpwpjsT mirj;J gpbf;fTk;.
- 10 Kiw ,ij kPz;Lk; nra;aTk;.



Note:

- Perform one session of exercise every day, for 4 weeks.
- Should not hold breath while doing any of these exercises.
- If you feel any discomfort during the exercise, stop the exercise.

APPENDIX – 4

Verbally administered numerical rating scale:

Frequency of Headache during a month:

The episodes of headache occurred in a month during the time of study are recorded in the sheet provided to the patient. The frequency of headaches for this period are compared between experimental and control group. Patients are asked to write the date at the column relevant if there was an episode of headache had occurred. A 'X' mark should be put in other columns where no headaches were felt.

	WEEK 1	WEEK 2	WEEK 3	WEEK 4
DAY 1				
DAY 2				
DAY 3				
DAY 4				
DAY 5				
DAY 6				
DAY 7				

Craniovertebral angle:

Subjects will be photographed looking straight-ahead in their natural stance using a digital camera. The cranio-vertebral angle (CV), reflecting the forward head posture position, is the acute angle created between the horizontal plane and the line from the tip of the C7 spinous process to the tragion.

Craniocervical flexion test:

The CCFT is performed with the patient in supine crook lying with the neck in a neutral position (no pillow) such that the line of the face is horizontal and a line bisecting the neck longitudinally is horizontal to the testing surface. Layers of towel may be placed under the head if necessary to achieve a neutral position. The un-inflated pressure sensor is placed behind the neck so that it abuts the occiput and is inflated to a stable baseline pressure of 20 mm Hg, a standard pressure sufficient to fill the space between the testing surface and the neck but not push the neck into a lordosis. The device provides the feedback and direction to the patient to perform the required five stages of the test. The patient is instructed that the test is not one of strength but rather one of precision. The movement is performed gently and slowly as a head nodding action (as if saying “yes”). The CCFT tests the activation and endurance of the deep cervical flexors in progressive inner range positions as the patient attempts to sequentially target five, 2-mm Hg progressive pressure increases from the baseline of 20 mm Hg to a maximum of 30 mm Hg as well as to maintain a isometric contraction at the progressive pressures as an endurance task.

When the test was first described, performance was scored via the pressure level that the patient was able to achieve (activation score) and hold for 10 repetitions of 10-second duration. A performance index was calculated based on the number of times the patient could hold the pressure level achieved for 10 seconds. For example, if a patient could achieve the second level of the test (24 mm Hg) and perform six 10-seconds holds with the correct action of craniocervical flexion, and then their performance index was $4 \times 6 = 24$. The highest activation score was 10 mm Hg, and highest performance index, 100

APPENDIX - 5

The Cervicogenic Headache International Study Group Diagnostic Criteria:

Major Criteria of Cervicogenic Headache

(I) Symptoms and signs of neck involvement:

(a) Precipitation of head pain, similar to the usually occurring one:

(1) By neck movement and/or sustained awkward head positioning, and/or

(2) By external pressure over the upper cervical or occipital region on the symptomatic side

(b) Restriction of the range of motion (ROM) in the neck

(c) Ipsilateral neck, shoulder, or arm pain of a rather vague nonradicular nature or, occasionally, arm pain of a radicular nature

Points (I) (a through c) are set forth in a surmised sequence of importance. It is obligatory that one or more of the phenomena in point (I) are present. Point (a) suffices as the sole criterion for positivity within group (I); points (b) or (c) do not. Provisionally, the combination of (I) (b and c) has been set forth as a satisfactory combination within (I). The presence of all three points (a, b, and c) fortifies the diagnosis

(II) Confirmatory evidence by diagnostic anesthetic blockades.

Point (II) is an obligatory point in scientific works.

(III) Unilaterality of the head pain, without sideshift.

For scientific work, point (III) should preferably be adhered to.

Head Pain Characteristics

(IV)

(a) Moderate-severe, nonthrobbing, and nonlancinating pain, usually starting in the neck

(b) Episodes of varying duration, or

(c) Fluctuating, continuous pain

Other Characteristics of Some Importance

(V)

(a) Only marginal effect or lack of effect of indomethacin

(b) Only marginal effect or lack of effect of ergotamine and sumatriptan

(c) Female sex

(d) Not infrequent occurrence of head or indirect neck trauma by history, usually of more than only medium severity

None of the single points under (IV) and (V) are obligatory.

Other Features of Lesser Importance

(VI) Various attack-related phenomena, only occasionally present:

(a) Nausea

(b) Phonophobia and photophobia

(c) Dizziness

(d) Ipsilateral "blurred vision"

(e) Difficulties on swallowing

(f) Ipsilateral edema, mostly in the periocular area.